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Data Base for Mineral Resources Exploration in the Peoples, Mississippi 7.5' Quadrangle

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DATA BASE FOR MINERAL RESOURCES EXPLORATION IN THE PEOPLES, MISSISSIPPI, 7.5′ QUADRANGLE

OPEN FILE REPORT 88-14

BY

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ABSTRACT

The Cretaceous McNairy Sand crops out in approximately two-thirds of the Peoples Quadrangle. The typical McNairy lithology is a fine- to coarse-grained, cross-bedded sand with iron oxide crusts and thin beds of iron oxide, cemented sandstone. The McNairy - Owl Creek contact is considered unconformable. The Owl Creek Formation is the youngest Cretaceous unit exposed in the map area and consists of sandy, silty, fossiliferous clay. This unit crops out above the McNairy on eastward trending ridges west of the Little Hatchie River. Erosion associated with the Owl Creek - Clayton contact has locally removed the Owl Creek in the northern quarter of the map area. The Clayton Formation, the basal Tertiary unit in the quadrangle, is composed of fine-grained, glauconitic sand in the unweathered outcrops. The Clayton crops out only on the top of the ridges west of the Little Hatchie River. An overstep in the northern quarter of the map area has resulted in Clayton lying in contact with the McNairy Sand.

The McNairy Sand is extensively utilized as a source of construction sand, and sand pits are common in the study area. Heavy minerals have also been noted in the interbedded clay and sand section of the McNairy, although they compose only approximatiy one percent of the sediment. The Paleozoic section beneath the Cretaceous sediments has had oil and gas shows in northeast Mississippi, but no obvious trapping mechanisms for hydrocarbon accumulation have been identified in the map area. The McNairy Sand is the only surface geologic unit which produces groundwater in sufficient amounts for domestic and municipal use.

No structure has been identified in the map area. Projections of the Owl Creek and Clayton formations updip would place outliers east of the Little Hatchie River, but field studies have failed to identify either of the units east of the river. Faulting may have resulted in some

displacement, but surface exposures have provided insufficient evidence to determine the type of structural deformation or orientation. Remote sensing, however, did indicate several lineaments grouped in the northwest corner of the quadrangle.

ACKNOWLEDGMENTS

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DATA BASE FOR MINERAL RESOURCES EXPLORATION IN THE PEOPLES, MISSISSIPPI, 7.5′ QUADRANGLE

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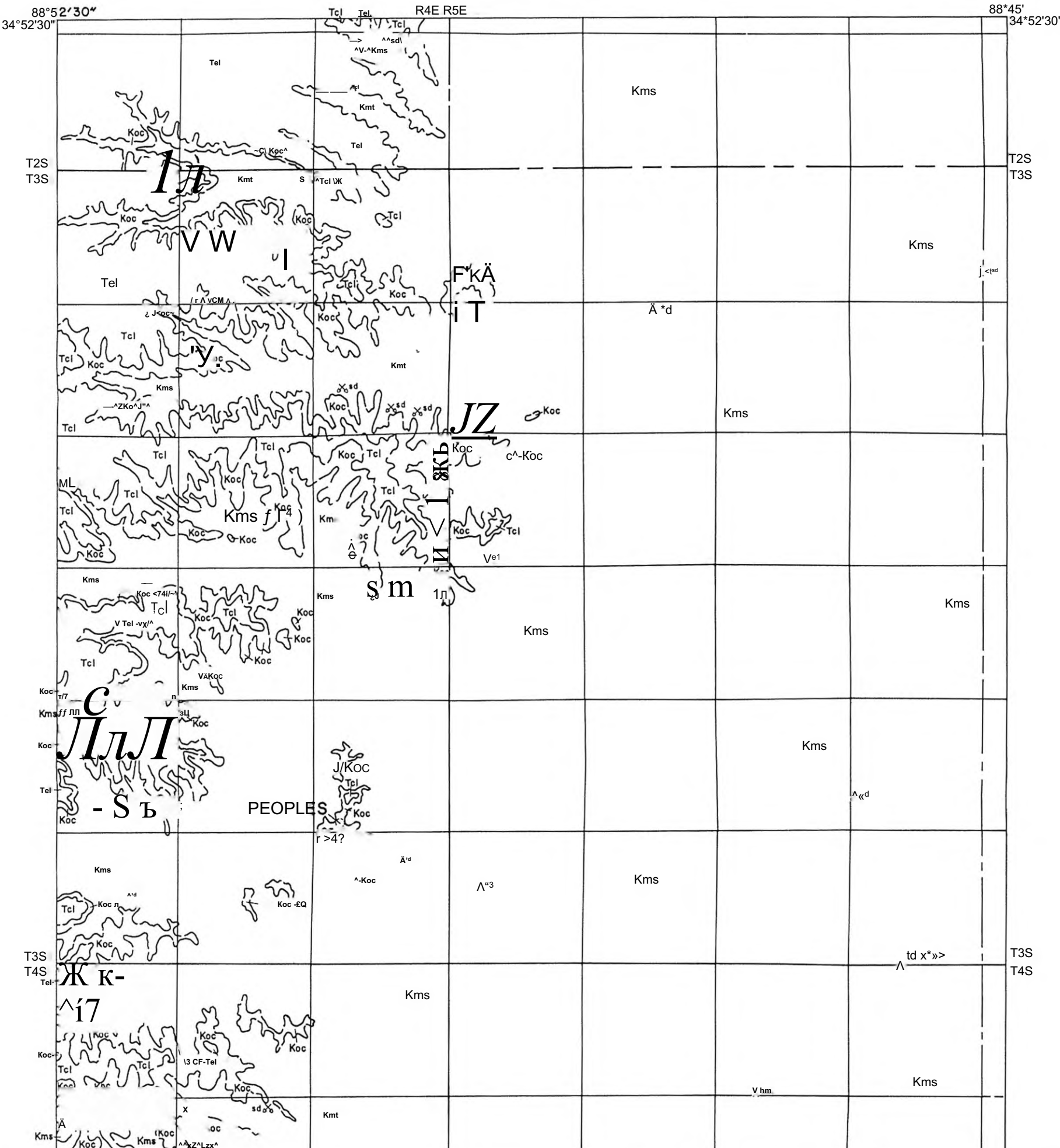
INTRODUCTION

The Peoples 7.5′ Quadrangle comprises the southeastern quarter of the Walnut 15′ Quadrangle. Exploration data bases have already been completed for the adjoining Walnut 7.5′ (Swann and Johnson, 1986) and Falkner 7.5′ (Swann and others, 1988) Quadrangles. As in the previous investigations, this report presents a general picture of the geology and identifies the mineral resources of the quadrangle. No subsurface data was available within the confines of the Peoples Quadrangle, so the geologic map was constructed entirely on the basis of surface exposures. Should subsurface data become available, the locations of the contacts should be reviewed and revised.

SURFACE STRATIGRAPHY

The Peoples Quadrangle is within the Mississippi Embayment, a large structural syncline (Stearns, 1975). Units of Tertiary and Cretaceous age overlie the indurated sediments of the Paleozoic basement whose structure and stratigraphy are not well known in northern Mississippi. Within the Peoples Quadrangle, three unconsolidated units of the Lower Tertiary and Upper Cretaceous crop out at the surface. The geologic map (Figure 1) was constructed from these surface exposures using the U.S. Geological Survey's 7.5′ Peoples Topographic Quadrangle as a base map. High altitude photography aided field interpretations.

88°52'30" R4E R5E 88*45'
34°52'30" 34*52'30"
T2S T2S
T3S T3S
T3S T3S
T4S T4S
34*45' 34°45'
88° 52'30" Kms R4 E R5 E 88°45'



GEOLOGIC MAP OF PEOPLES QUADRANGLE

FIGURE 1

McNairy Sand

The oldest and most extensive map unit is the Late Cretaceous McNairy Sand, a member of the Ripley Formation (Keroher, 1966; Dockery, 1981). Although no well data is available in the Peoples Quadrangle, the Falkner No. 1 well in the adjoining Falkner Quadrangle contains 246 feet of McNairy Sand. This unit has been informally divided into a lower section of cross-bedded sands, a middle section of interbedded sand and clay, and an upper section of cross-bedded sand similar to the lower unit.

The interbedded sand and clay section is exposed at lower elevations within the quadrangle. The most notable exposures are in roadcuts on the west bank of the Little Hatchie River at Waldon Bridge (SW 1/4, Sec. 5, R5E, T3S), road cut exposures on the west bank of Silver Springs Creek (SE 1/4,Sec. 34, T3S, R5E) and in the banks of the Little Hatchie River near Pleasant Ridge Cemetery (NE 1/4, Sec. 1, T4S, R4E). Exposures of this section are also common in the NE 1/4 of the quadrangle between the Hatchie and Little Hatchie rivers.

Conant and McCutcheon (1941) suggested that the clay beds of this section occur at 75 to 100 feet below the unit's upper contact and are underlain by a cross-bedded sand lithology. Stephenson and Monroe (1940) considered the clay beds to be lenses. Geologic mapping confirmed the findings of Conant and McCutcheon that the clay beds are close to the middle of the unit at a persistent stratigraphic level. Although exposures of the base of the sand and clay section are limited, the lithology does appear to be a cross-bedded sand, similar to the upper McNairy section.

The upper section of the McNairy Sand typically consists of cross-bedded, medium- to coarse-grained, micaceous sands with Ophiomorpha sp. common in many outcrops. Abundant iron oxide crusts and thin beds of iron oxide cemented sandstones are common with some outcrops

containing tubular "pipes" of iron oxide. Near the base of the upper unit, clay clasts and bioturbated beds are locally abundant. Since this upper unit has been extensively used for road construction, sand pits are common in its outcrop belt. One such example can be found east of the gravel road on the south side of Camp Creek (SW 1/4, Sec. 12, T3S, R4E).

The top of the McNairy section is a zone of poorly preserved fossils in a matrix of argillaceous, medium- to coarse-grained sand. This zone is at the same stratigraphic level as the Chiwapa Sandstone Member (Mellen, 1958) which outcrops south of the Peoples Quadrangle and approximately three miles east of Ripley, Mississippi. The McNairy, however, differs from the Chiwapa in its lack of calcium carbonate cement.

Owl Creek Formation

The Owl Creek Formation, the youngest Cretaceous unit within the map area, is relatively thin and has few fresh outcrops. The unit typically consists of sandy, silty clays with abundant fossiliferous zones such as those exposed in roadcuts on the south side of Bridge Creek (SE 1/4, Sec. 2, T3S, R4E). These fossils have been preserved as molds and casts; several bivalve taxa have been noted, and the gastropod Turitella trilira has been identified. The Owl Creek typically weathers to a light gray saprolite and may contain a small amount of glauconite. An increased glauconite content may account for some dark-red saprolite locally developed within the unit.

Clayton Formation

The Clayton Formation (Chalybeate Member) is the second most extensive unit in the map area. The Clayton consists of a fine- to medium-grained, glauconitic sand with medium- to coarse-grained sand near the base. The Clayton typically weathers to a red, very argillaceous, fine-grained, massive sand, reflecting the weathering of large amounts of

glauconite. No fossils have been noted from the Clayton, and the discontinuous basal limestone unit noted in adjoining areas has not been identified in the Peoples Quadrangle.

Within the Peoples Quadrangle, the Clayton is present only at higher elevations along the narrow ridges, thickening noticeably in the northern half of the map area and coinciding with a Clayton overstep of the Owl Creek Formation. This stratigraphic relationship has resulted in Clayton resting disconformably on Owl Creek as well as McNairy Sand. Noticeable thickening of the Clayton has also been noted in the Falkner Quadrangle (Swann and others, 1988) which borders the Peoples Quadrangle to the West. Figure 2, a series of cross sections, shows the near surface geology of the quadrangle.

A tan to light-brown silt near the center of Section 33, T3S, R5E may represent a small outlier of loess associated with the more extensive deposits to the west and north. This area of silt is an unusual occurance, lying well within the McNairy Sand outcrop belt, but it is not extensive enough to be separately mapped. Quaternary deposits associated with the major streams of the quadrangle were not mapped.

Mapping Problems

Surface mapping was relatively simple since only three surface units crop out in the study area. Where the Owl Creek is present, the identification of the overlying Clayton and the underlying McNairy Sand is reliable, but where the Clayton disconformably overlies the McNairy Sand, the contact is more speculative. In these situations, the basal Clayton is typically a medium- to coarse-grained sand containing scattered granules or small gravel. In areas of abundant surface exposures, this contact can be followed, but in many instances identification is more difficult and speculative.

STRUCTURE

No major structural features have been identified within the map area. Regional dip appears to dip northwest, possibly resulting from the structural feature referred to as the Tippah Dome by Gazzier and Bograd (1988). Further study is needed to verify this relationship.

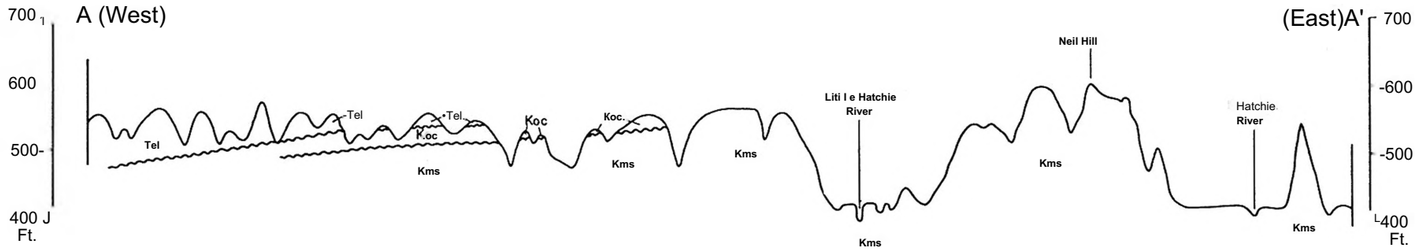
The Clayton and Owl Creek formations crop out on narrow eastward-trending ridges on the western side of the Little Hatchie River. Eastward projections of these units would place them on the top of ridges on the eastern side of the river at elevations over 680 feet. The exposed lithology on the ridges east of the Little Hatchie River, however, is consistent with the McNairy Sand, suggesting that this area may be stratigraphically higher than the west side of the river because of faulting. This structural situation would be similar to that described for Muddy Creek (Swann and others, 1988), but surface exposures are insufficient to identify structural style or orientation.

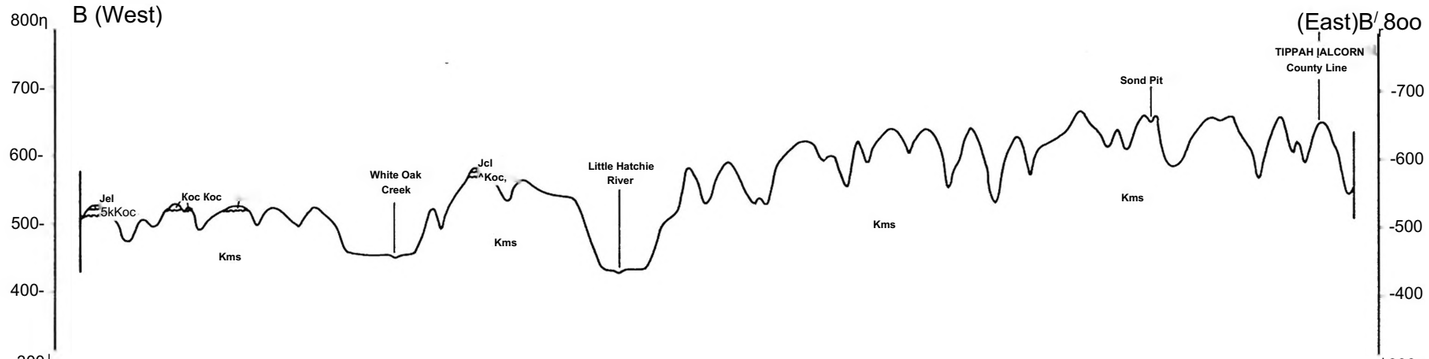
MINERAL RESOURCES

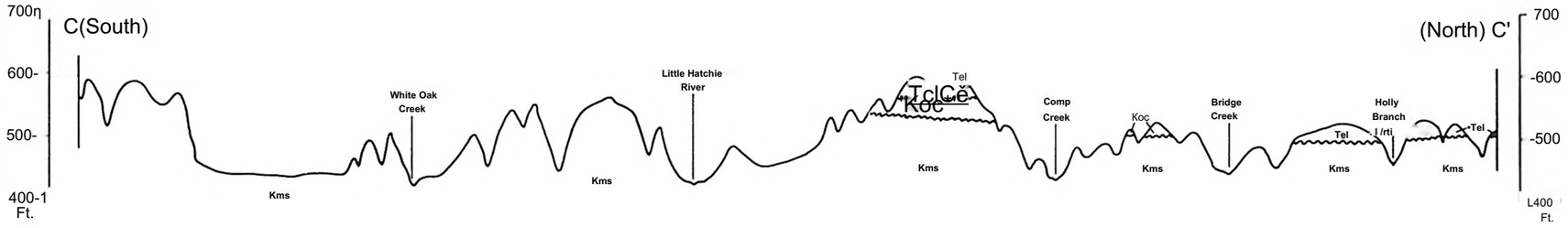
The mineral resources and mining activity in the Peoples Quadrangle are illustrated in Figure 2. Mineral resources were noted by examination of surface outcrops, but careful economic and geologic analysis is recommended prior to utilization.

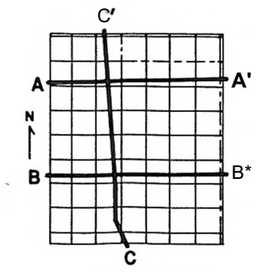
Heavy Minerals

The middle sand and clay section of the McNairy Sand appears to have higher concentrations of heavy minerals than the upper McNairy section. Dark, heavy minerals have been observed in two outcrops of the interbedded clay and sand section, but they compose only approximately one percent of the total sample. The sizes of the heavy mineral grains range from medium- to very fine-grained sand.









LOCATION MAP

VERTICAL SCALE IS RELATIVE TO SEA LEVEL

0 2 Mi.

0 2 3 Km

HORIZONTAL SCALE; 1*24,000

GEOLOGIC CROSS SECTIONS - PEOPLES QUADRANGLE

FIGURE 2

Sand

Sand from the upper section of the McNairy has been extensively used in road construction. Sand pits are common throughout the outcrop belt, many with as much as 30 feet of exposure standing in a vertical face. Thin iron oxide cemented sandstones are characteristic in these exposures.

Oil and Gas

The Paleozoic section, which underlies the Cretaceous-aged sediments, has had oil and gas shows in the region, but field mapping has not identified any local trapping mechanisms which could result in hydrocarbon accumulation. The potential for hydrocarbon production is considered greater in some of the adjoining quadrangles which have significant structure. (See Swann and others (1988) for a summary of hydrocarbon shows in the area.)

REMOTE SENSING ANALYSIS

Satellite photography in the near infrared portion of the spectrum can be used to identify lineaments which may represent faults and/or fracture zones. These zones are often associated with increased fracture porosity, which is reflected in the plant cover and detected by photography. Tonal circular anomalies also reflect changes in the reflectivity of an area's plant cover. These changes are thought to reflect migration of hydrocarbons and/or other fluids to the surface in very small amounts.

Geological interpretations of satellite photography must be used with caution. Lineaments occasionally bear no relationship to the geology, but are merely a product of chance. They may also reflect cultural features which should be excluded from consideration. Tonal circular anomalies can reflect topography or the migration of fluids

other than hydrocarbons. A thorough understanding of the area's geology should be used in evaluating the significance of all interpretations from satellite photography.

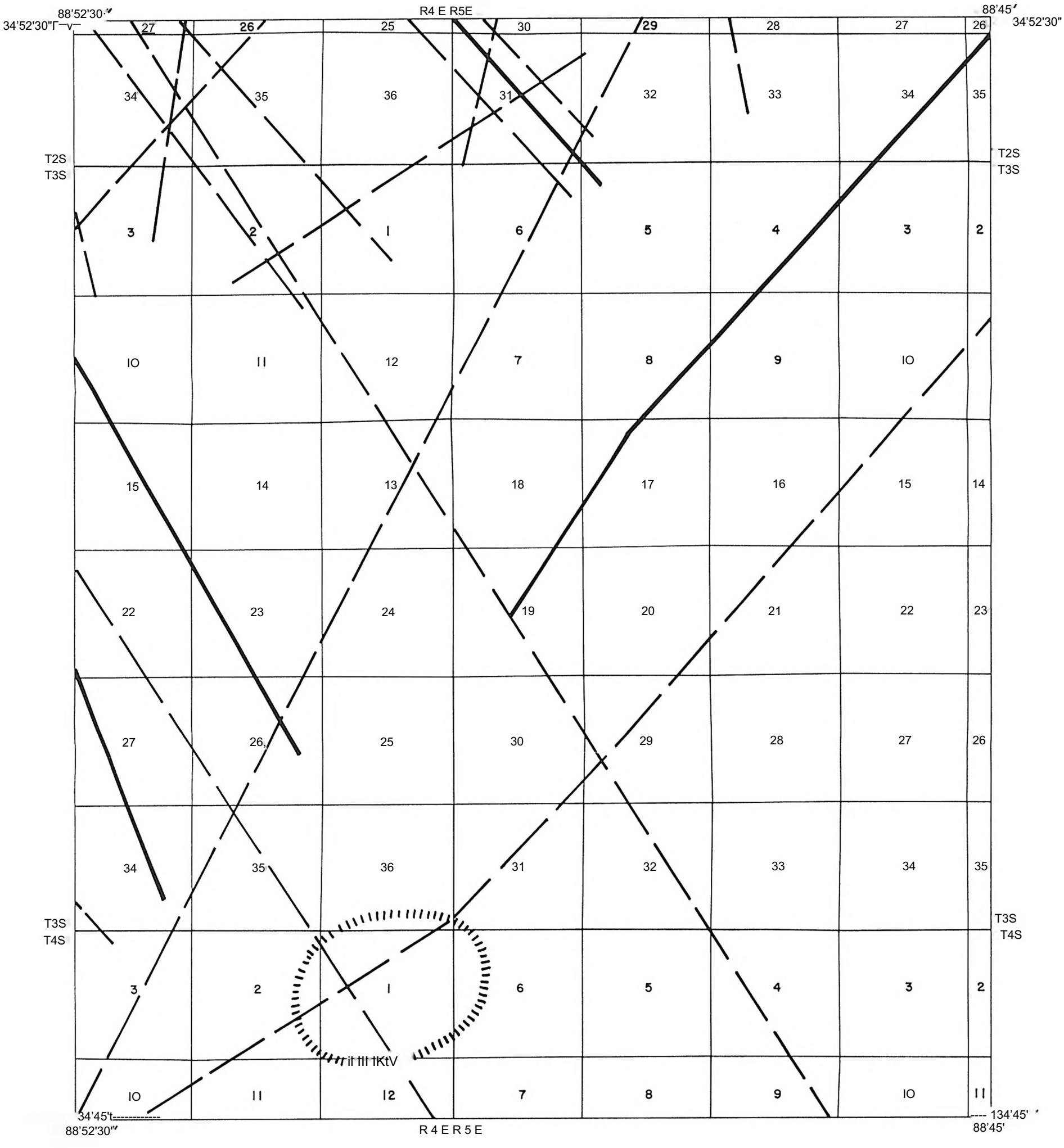
Lineaments within the Peoples Quadrangle (Figure 3) may represent faults and/or fracture zones. These lineaments are heavily concentrated in the northwest corner, and generally extend north of the map area. Orientation is northeast or northwest. The southeast corner of the quadrangle contains four widely spaced lineaments. The only circular tonal anomaly in the map area is centered near Pleasant Ridge Cemetery (Sec. 1, T4S, R4E) . Field mapping has revealed no apparent structure, and the cause of the circular anomaly is unknown.

GROUNDWATER RESOURCES

Due to the sparse population, little data is available for the evaluation of groundwater conditions, but some general conclusions can be made based on field observations. The Clayton Formation, present in the western half of the quadrangle, is generally too thin and highly weathered to produce significant quantities of groundwater. In areas where the Clayton is thick, however, sufficient groundwater may be obtained for domestic use. Since the Clayton is the top of the stratigraphic column in this quadrangle, water levels would be subject to fluctuation resulting from climatic conditions, and the sands would be subject to surface pollution.

The silts and clays of the Owl Creek Formation are not sufficiently permeable to produce usable amounts of groundwater. The Owl Creek contains insufficient sand for groundwater production and likely forms a confining unit.

The McNairy Sand does produce groundwater in sufficient amounts for domestic and municipal use. This thick section of sand would yield generous amounts of water to properly



LANDSAT INTERPRETATION OF PEOPLES QUADRANGLE

FIGURE 3

constructed wells. In the sand and clay section, zones of saturated sands have been noted above the clay beds, representing perched water tables. A spring has been noted on the east side of the gravel road, on the south bank of Camp Creek (Sec. 12, T3S, R4E) flowing from the McNairy Sand into Camp Creek. The McNairy Sand would be susceptible to surface pollution.

FURTHER INFORMATION

The Mississippi Mineral Resources Institute maintains a copy of the geologic and remote sensing maps at a scale of 1:24,000. These maps are on mylar film, and blue line copies can be obtained for the cost of reproduction. The senior author mantains a copy of field descriptions and a base map with numbered field stations. These data may be examined at the Institute's main office on the campus of The University of Mississippi.

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